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A modest additional supply of 1980 Nuexco pocket calendars is still on hand. Calendars are available on request.

We wish all of our Subscribers a happy and prosperous 1980.

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PUBLIC AND GOVERNMENT POLICY

Recent events involving *Iran* constitute one of those special situations in which national perspective is brought into focus more realistically. Many areas of public policy, including energy policy, may be importantly affected. One result is likely to be a stronger emphasis on concrete energy programs utilizing proven practical approaches, and less willingness to base programs on esoteric hopes. Cutbacks in, and added threats to, the oil supply will necessitate more emphasis on practical solutions. Nuclear power and conservation should both move up a notch in governmental priorities.

None of this will significantly increase either short-term uranium demand or the number of *new* nuclear plants ordered in the next few years. However, a slowing, perhaps even a trend toward reversal, of legal and regulatory barriers may become more in vogue.

South Africa is currently enjoying an economic boom credited mainly to:

1. Record gold prices, which provide adequate domestic capital for industrial development. Dependency on foreign investment has been greatly reduced.

2. Prime Minister P. W. Botha has been, and is continuing to be, more progressive than expected. Confidence in South Africa's future is growing. There is more optimism that the nation's social problems will eventually be solved. Mr. Botha has been able to maintain the confidence of the most conservative political bloc while, at the same time, gaining enthusiastic support from the moderate bloc, which did not support his appointment.

3. National self-sufficiency has increased, partly as a result of needs arising from past political semi-isolation. South Africa has inventoried at least a two-year supply of oil. A coal liquifaction plant, Sasol I, has successfully operated for several years. Construction of Sasol projects II and III is progressing on schedule. Roughly half of the nation's oil supply will soon be drived from coal. As far as energy is concerned, South Africa may already be less vulnerable to external conditions than other industrialized nations.

Because uranium is a by-product of a strong gold mining industry, and long-term investment is now more readily available, South Africa probably enjoys the strongest uranium *production* position of any major producer nation. However, its *marketing* position continues to be affected by political considerations. On balance, however, the South African position appears substantially stronger today, compared to two or three years ago.

Australia is experiencing an economic boom based on energy and resources in general. Prime Minister Fraser's free enterprise-oriented policies are dismantling barriers to resource development and increasing incentives for domestic and foreign investment.

The uranium industry continues to move forward with concrete action in respect to mining and production. However, competition for Australian capital and manpower is increasing as interest in other resource development expands. Moreover, market conditions have tempered uranium development expectations. It presently appears unlikely that Australian production capability will expand more rapidly, and to a greater extent, than world markets can absorb.

In a speech given recently in San Francisco, Deputy Prime Minister Anthony strongly restated his government's disapproval of US antitrust actions. He claimed that the US is seeking to enforce laws which seriously compromise international commerce. He criticized the US for acting according to an antitrust double standard, since acts for which Australian uranium companies are being sued occurred during a US-imposed prohibition on imports of uranium for use in domestic reactors. That action, he pointed out, closed 70 percent of the market to non-US producers.

In the *UK*, legislation designed to prohibit the enforcement of multiple damage judgments and the granting of certain rights of recovery against British companies penalized under US antitrust laws is currently passing through Parliament. Although it has not yet become law, the bill is attracting attention in other nations, and may serve as a model for similar legal actions.

The government authorized selection of Westinghouse Electric Corporation technology for the country's next nuclear power plant. The project will be part of Britain's newly announced nuclear power expansion program, and construction is scheduled to begin in 1982. Nuclear power output is being

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accelerated by the government to meet energy demands when North Sea oil production begins to decline in the 1990's.

AUSTRALIA

It was announced this month that the Australian federal government will sell its 50 percent share in Ranger to Peko-Wallsend Ltd. Peko will pay the government A$125,000,000, refund the A$40,000,000 already spent by the government, and relieve the government of commitments to finance 72.5 percent of the capital cost of the project (total project development cost is currently estimated at A$315,000,000, exclusive of the A$125,000,000 payment by Peko to the government). A new company, Energy Resources of Australia Ltd. (ERA), will be formed, which will hold a 75 percent interest in the Ranger project (the 25 percent now held by Peko in its joint venture with Electrolytic Zinc plus the 50 percent to be acquired from the government). Peko will own 50 percent of ERA's equity, Australian investors will be offered 25 percent, and non-Australian uranium consumer interests will hold the remaining 25 percent. Despite recent press reports, no final decision has been made regarding the distribution of equity among the non-Australian consumers, although Japan, the FRG and the UK are seen as front runners.

The sale of the government's share to one of the two existing partners and the participation of overseas consumers in the equity of the Ranger project are seen as positive signs that will ensure that there are markets for the uranium and that the project continues to move forward on a timely and sound financial basis.

CANADA

Public hearings will begin in January 1980 in Saskatchewan to consider all facets of uranium development in the province. The two primary projects to be discussed are the Key Lake project led by Saskatchewan Mining Development Corporation, and the UF_6 conversion facility proposed by Eldorado Nuclear Ltd. for the Warman district near Saskatoon. The hearings are expected to continue through March. Decisions concerning continued development should be handed down later in the year, possibly by early summer. Rulings are expected to favor continued uranium development, although an anti-nuclear faction remains strong in Saskatchewan and within the province's ruling political party, the National Democratic Party (NDP). At a recent federal convention of the NDP, a motion for a moratorium on uranium development was defeated, but only by a margin of 537 to 402. However, Saskatchewan Premier Allan Blakeney had made it clear early in the convention that his government's position would not be affected by any policies the federal party adopted.

JAPAN

Japan's nuclear and uranium positions were covered in considerable detail in Nuexco's Topical Report published in September 1979, entitled *Uranium Supply and Demand in Japan*. Since then, three further developments of significance have occurred. First, a Japanese utility concluded two purchase contracts providing for delivery of a total of 4,400,000 pounds U_3O_8 for delivery in the 1980's. Prices in both agreements are related to then-prevailing market conditions.

Second, price negotiations between Japanese buyers and overseas sellers for 1981 deliveries have resulted in settlement prices considerably below the sellers' original expectations. Initial asking prices were more than $50 per pound U_3O_8, but settlements achieved were in the range of $44 to $46 per pound. It appears Japanese buyers are sensitive to both the current price decrease and to the buyers' stronger position in the market.

Finally, the sale of the Australian government's share of Ranger to Peko-Wallsend Ltd. will involve Japanese utilities purchasing a part of Peko's 75% interest in the Ranger project. This will ensure additional long-term contracts for the supply of Ranger uranium to Japan. Thus, Japan's already substantial uranium inventories would be increased, making Japanese utilities even less likely candidates for additional purchases during the 1980's.

UNITED STATES

The US Internal Revenue Service has issued a letter ruling (LTR 7943161) concerning the tax consequences of a producer borrowing uranium for resale. The ruling holds for the case in question that the borrower realizes no gain or loss for income tax purposes when it borrows uranium from a lender. The subsequent sale by the borrower will qualify as a

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short sale, for tax purposes, and the borrower will again incur no gain or loss at the time of sale. It is only when the borrower repays the uranium to the lender that the short sale will be considered by the IRS as a closed transaction for tax purposes, and gain or loss will be recognized at that time. The tax ruling will facilitate US producers in borrowing uranium, either to make up shortfalls or as an alternative to borrowing in the money market.

The question of overlapping Nuclear Regulatory Commission (NRC) and state jurisdiction regarding uranium mill tailings in agreement states (see Nuexco Report No. 133) has been resolved by Congress. (The law, enacted as a rider to the Surface Transportation Assistance Act signed by the President in late 1979, provides the NRC with authority to monitor and assist cognizant agencies in agreement states in bringing state regulations concerning mill tailings up to the level of equivalent federal regulations during the three-year interim period set forth in the federal uranium Mill Tailings Act of 1978.) The three-year grace period, which expires November 8, 1981, is provided in the Mill Tailings Act to allow for such upgrading of regulations by the states. It now is clear that there is no concurrent NRC jurisdiction during the grace period.

Governor Bruce King of New Mexico said he will submit a proposal to the state legislature in January 1980 to increase the severance tax on uranium and other energy minerals. The Governor did not say how much of an increase he will seek for uranium, but he did express a desire to raise another $65,000,000 to $75,000,000 per year in energy taxes. The severance tax on uranium in New Mexico was last increased in 1977.

A sliding scale was enacted, with the highest bracket at $1.99 per pound U_3O_8, plus 12.5 percent of the incremental selling price above $40.00 per pound U_3O_8. The 1980 New Mexico legislature session will last only 30 days and will be confined to revenue and tax matters.

The New Mexico Environmental Improvement Board has adopted stricter state regulations for the uranium industry. These include a ban on construction of uranium mills until a license is issued regarding mill tailings disposition, and the requirement for a half-mile buffer zone around tailing sites until such time as the site becomes inactive and reclaimed. It also requires bonding of a mill license holder to ensure tailings reclamation and allows for increased public participation in the licensing process for uranium mills.

Three spot transactions involving US sellers closed this month at prices close to Exchange Value. These transactions notwithstanding, there remains a substantial imbalance in the near-term market. Totals of active inquiries to purchase and sell in 1980, listed in the *Market Opportunities* section of this Report (pp 5.0 and 5.1), are as follows:

Thousands of Pounds U_3O_8	
Available for Sale in 1980	Inquiries to Purchase in 1980
3,750	2,450

Of the total available for sale in 1980, approximately one-half involves inventory sellers. It has largely been this influence of inventory sellers that has been responsible for the downward pressure on the dollar price of uranium in recent months. The extent to which these sellers are determined to sell will probably determine the course of the uranium market in the near future.

PRICING

The **Exchange Value** moved downward slightly this month to $40.75 per pound U_3O_8 The decrease from last month represents additional pressure on the market by uranium inventory holders wishing to make spot sales.

From the standpoint of the producer, especially the US producer, the current uranium market outlook is bleak. While prices are falling, costs are escalating, and producers are rapidly being caught in the squeeze. The principal reasons for increased production costs are:

1. *Higher wages.* This is primarily due to inflation and to competition for miners, especially underground miners, among mineral producers.
2. *Lower Grade.* Grade is falling off dramatically in the US: the average uranium ore grade for 1979 will be considerably lower than that of 1978, and is anticipated to be even lower in 1980.
3. *Regulatory compliance.* Meeting environmental, health and safety regulations is becoming increasingly expensive.
4. *Higher taxes.* Most uranium mined in the US is now subject to substantial severance taxes, and these taxes will probably be increased.

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URANIUM MARKET

As costs increase, uranium prices continue to slip. The near-term outlook for producers is clouded by competition in the market from utilities selling inventories. Also hampering producers in both the near-term and longer-term markets is the reluctance of buyers to sign contracts which may eventually require them to pay higher than the generally perceived market price at the time of delivery. This makes it difficult for producers to justify making large expenditures for mine development, since they lack reasonable assurance that they will be able to earn a return on the funds invested. This applies even more strongly to potential new US producers.

The extent to which the current market appears unfavorable to producers is often masked by the rapid rise in the price of uranium during the 1974-75 period. However, that price rise started from the extremely depressed market of the early 1970's. In addition, inflation and other factors have largely wiped out the gains made during the strong seller's market of 1974-75. To better understand the current position of the US uranium industry, it is instructive to work through a simple exercise to estimate whether today's Exchange Value is comparable to what might be considered an incentive price for a healthy and vigorous uranium industry.

One method for making such a determination would be to compare today's situation to a previous period in which the uranium industry was generally thought to be healthy, and the price was considered an incentive price to maintain or expand production levels. The year 1960 is generally thought of as a good year for the industry. At that time, the average price paid by the AEC was $8.60 per pound U_3O_8. Adjustments need to be made to this price to account for changes in the industry since 1960:

1. *Ore Quality.* The average ore grade mined in the US during 1960 was 4.8 lbs U_3O_8 per ton. The average grade for 1979 is expected to be less than half that. Since mining and milling costs are directly related to grade, a current price of at least twice the 1960 price, or $17.20 per pound U_3O_8, would be required to provide the same degree of incentive. (In addition, ore deposits are deeper today than in 1960, especially for most potential new US production, but this effect is neglected here.)

2. *Inflation.* The effects of inflation since 1960 can be estimated using US government indexes. (Because the late 1950's and early 1960's were years of very low inflation, and because prices paid by the AEC were relatively constant during that period, the results of this simple calculation are not very sensitive to the year chosen as a base point.) The Producer Price Index for Industrial Commodities increased approximately 250 percent from 1960 to September 1979. The Average Hourly Earnings in Metal Mining (SIC 10) increased approximately 350 percent in the same period. Thus, the average increase in the cost of labor and materials for uranium mining from 1960 to late 1979 may be considered to be about 300 percent.

3. *Other.* Another factor to be considered is the addition of health, safety and environmental costs to the cost of uranium production. Nuexco estimates that the total added cost involved in these factors for a US underground mine is about $5.00 per pound U_3O_8. Finally, the added cost of severance taxes is one to two dollars per pound or more, depending on the jurisdiction and selling price.

Thus, the late 1979 selling price equivalent to $8.60 in 1960 would be considerably higher than current Exchange Value, i.e. $8.60 x 2 (ore quality) x 3 (inflation) + health, safety and environmental costs + taxes. It should be emphasized, however, that this simple calculation is only intended to translate what was once shown to be an incentive price into today's dollars and today's mining conditions. The purpose is for comparison only, to demonstrate that a price level equal to today's Exchange Value may not, in fact, be a strong incentive to maintain a healthy domestic production industry, although some existing or under-construction operations might have attractive rates of return at prices at or below current Exchange Value. However, it is uncertain how many new US production centers will move forward under current conditions. Also, it is likely that some US output considered "firm production," as discussed in Reports Nos. 133 through 136, will not, in fact, be produced, because economically marginal facilities may be cut back. The ultimate result may be a shift in uranium production to non-US producers, thus generally increasing dependence of the US on imported uranium.

The **Transaction Value** moved down substantially this month to $42.30 per pound U_3O_8. The principal reason for the change was the inclusion in the Transaction Value calculation of the qualifying transactions which closed this month, thus allowing

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several old transactions to drop from the sample of at least ten transactions totaling ten million pounds U_3O_8. However, the time period still extends over six months; thus the Transaction Value still lags the Exchange Value.

The **Loan Use Charge Rate** remained at seven percent. One loan transaction closed this month at a use charge rate consistent with the Nuexco Loan Use Charge Rate, and several lots of uranium are currently available for loan at comparable rates.

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TOPICAL ESSAY

URANIUM PRICES & PRICE MECHANISMS

This is the fourth essay in a series on various aspects of the uranium market.

Introduction

Uranium prices and price mechanisms are at once the most discussed, most argued about, perhaps most interesting and, for obvious reasons, most sensitive subjects in the uranium market. Accordingly, the following discussion focuses on definitional, philosophical and prccedural considerations, as opposed to specific prices.

Types of Prices

Defining certain terms provides a frame of reference. The types of prices defined below are sometimes used in combination, especially in long-term contracts.

1. *Fixed Price:* A fixed price is one that is established at the time of contracting. Fixed prices may take a number of forms. The most common include:

   a. A single, fixed price applicable to a single delivery, such as *X* dollars per pound U_3O_8 for 100,000 pounds U_3O_8 to be delivered in June 1980; or single, fixed prices applicable to a series of deliveries, such as *X* dollars per pound U_3O_8 for delivery of 50,000 pounds U_3O_8 per month, May and August 1980.

   b. A series of fixed prices for a series of deliveries. For example, deliveries of 50,000 pounds U_3O_8 per month, May and August 1980, at prices of *X* dollars per pound U_3O_8 in May and *Y* dollars per pound of U_3O_8 in August.

   c. A single price escalated at a fixed annual or monthly rate, from the date of contract to the date of delivery. For example, *X* dollars per pound U_3O_8 escalated at *Y* percent annually. This approach can be applied to a single delivery or to a series of deliveries.

In each case, the exact price to be paid is known at the time of contracting, or can be calculated with absolute certainty.

2. *Base Price Adjusted:* This is a price which is adjusted on some basis other than a pre-established fixed escalation rate. The most common form of adjustment involves the use of government-published indexes. Those most frequently used in the United States are the labor and materials indexes published by the Department of Labor's Bureau of Labor Statistics. Example of commonly used labor indexes are:

   a. Average Hourly Earnings, Metal Mining (SIC 10).

   b. Average Hourly Earnings, Primary Nonferrous Metals (SIC 333).

   c. Average Hourly Earnings, Chemicals and Allied Products (SIC 28).

   Examples of other commonly used indexes are:

   a. Producer Price Index, Industrial Commodities.

   b. Implicit GNP Deflator (published quarterly by US Department of Commerce).

Most of these indexes are reprinted on page 4.5 of this Report. Similar indexes are published in Australia, Canada and South Africa.

3. *Cost Related Price:* This is a price based on the seller's cost of production, plus some margin for return on investment. The profit margin may be a fixed amount per pound U_3O_8, a fixed amount adjusted for inflation, a percentage of cost, or may even be expressed as a percentage return on investment. This has a number of implications. The buyer will usually have the right to audit the seller's books of account. The necessity of precisely defining cost can lead to difficult negotiations and lengthy contracts. A further complication often comes from the buyer's attempting to link the producer's profitability to production cost to serve as an incentive, or by some other means, to ensure that there are no disincentives to efficient operation on the part of the seller.

4. *Floor Price:* This term is used to describe the minimum price under contracts which provide more than one basis for price determination. Floor price itself may be a fixed price, a base price adjusted, or a cost-related price.

5. *Market Price:* The term *market price* is subject to greater variation and misunderstanding than any of the others. A dictionary definition is that market price is the actual price at which a given commodity is currently sold, or has recently been sold, in the open market; that is, not a forced sale, but a sale in the usual and ordinary course of trade and competition, between sellers and buyers equally free to bargain, as established by records of late sales. The latter definition may be more akin to what is normally thought of as a *spot market price*. In the uranium market, however, a contract providing for sales

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at market price (also known as *world market price, world price, fair market price,* etc.) is usually designed to establish, at the time of the contract, ground rules for determining, at or near the time of actual delivery of the material, the price to be paid. It can be used alone or in conjunction with a floor price.

Two basic methods of determining market price are in use today. One is to refer to a published price available to both parties. The second is to have the concerned parties negotiate a price. A contract in which market price is negotiated will usually contain guidelines for carrying out the negotiation, including a method for determining the contract price if the parties are unable to establish one through negotiation. Often a method is provided for choosing an expert or panel of experts which will determine the price in the event the parties fail to reach agreement by negotiation. The contract will usually delineate what evidence is acceptable to the parties for consideration in setting the price. While there are several methods for determining market price, the usual objective expressed in most long-term contracts is for the parties to achieve, for *that* contract, and for the specific conditions pertaining to it, an appropriate price at the time of delivery.

Uranium vs. Other Commodities

Uranium, unlike stocks, bonds, many metals and agricultural products, has no centralized marketplace where market makers buy and sell it. Uranium has nothing akin to the markets provided for stocks and bonds by the New York Stock Exchange and other exchanges; for copper and other metals by the London Metals Exchange (LME), or for wheat and other agricultural products by the Chicago Board of Trade. For example, in the stock market, a specialist will buy and sell shares of a given stock at "bid" and "asked" prices that the specialist makes available to all market participants. The level of the bid and asked prices, and the spread between them, depend on supply and demand for that particular stock. Likewise in the commodity exchanges, fungible commodities are bought and sold in standard lots using standard contracts. Each business day, bid and asked prices are published, as well as transaction prices. For many commodities, direct long-term transactions between buyer and seller are priced in accordance with the published exchange price at the time delivery is made, even though the transaction otherwise has nothing to do with the exchange. For example, copper is usually sold under contracts based on the LME price even though only a very small percentage of world copper production is physically traded through the LME.

The uranium market is different in that there is no market maker for uranium. Consequently, there is no direct equivalent in the uranium market of an LME quote. There has been much speculation about why such a market for uranium has not developed. Certainly uranium is a fungible commodity in the sense that a "standard concentrate" can be produced (unlike coal and oil, the characteristics of which vary widely among production lots and producers), and transportation is an unimportant factor in the price. There are several possible explanations for the lack of uranium market makers:

1. *Licensing:* Since in most countries the possessor or uranium must be licensed, a market maker might have difficulty in accepting delivery under a purchase contract if the material has not already been resold at the time of delivery.

2. *Government Controls:* The governments of most uranium-producing countries maintain end-use controls over uranium, reducing its fungibility. Some governments require that sales of uranium be made only to end users. Such regulations make it difficult for a market maker to operate.

3. *Conversion Contractors:* Historically, most uranium production has been shipped immediately to conversion facilities. Contractual relationships with the conversion contractors often greatly restrict the free marketability of uranium located at these facilities, and thus would be disadvantageous to a potential market maker.

4. *Limited Market:* Natural uranium currently has only one commercial use, as a power reactor fuel. Thus, there is only one class of customer, with relatively few members. Also, several brokerage firms operate extensively in the world-wide uranium market, thus making uranium easier for producers to sell and utilities to purchase. In any event, the need for a formal market maker in uranium has not been apparent, and the lack of such a real need is probably the most important reason why there are, in fact, no market makers. While a few traders in uranium buy and sell for their own account, they do not do so in an organized fashion, with published bid and

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asked prices. Rather, the traders usually operate informally, buying and selling when particularly good opportunities present themselves.

Since there is no organized market for uranium, there is thus no equivalent to an LME price for uranium based on a specific set of selling conditions. However, many buyers and sellers world-wide accept Nuexco's Exchange Value as an equitable reflection of conditions for spot and near-term transactions.

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BY-PRODUCT URANIUM FROM PHOSPHATE—PART II

Introduction

Marine phosphorite deposits in the Western US are of increasing economic interest due to the demand for industrial and agricultural phosphate products. Uranium recovery from phosphoric acid was not a serious consideration until four to six years ago. Presently, one company is scheduled to begin recovering uranium by early 1980 and two are in the advanced stages of recovery preparations which will utilize phosphate rock mined in southeastern Idaho.

The principal phosphate deposits of the Western US are restricted to the Phosphoria Formation of Permian Age. The formation is considered to cover an area of about 135,000 square miles in Montana, Idaho, Wyoming and Utah. Figure 1 shows the approximate extent of the Phosphoria Formation and the main areas of economic development.

The Phosphoria Formation varies in thickness from about 200 to 1500 feet throughout portions of the four states. In general, the entire depositional sequence, including the Phosphoria Formation, has been intensely folded and faulted into rugged terrain characterized by northwest-trending mountain ranges. The Phosphoria Formation is primarily situ-

Figure 1
GENERAL LOCATION OF WESTERN PHOSPHATE FIELD SHOWING MAIN AREAS OF ECONOMIC INTEREST

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ated at varying altitudes between 3,000 and 10,000 feet above sea level.

The Formation is composed of five members, of which the lowermost—the Meade Peak Phosphatic Shale Member—contains the only significant phosphate resources of the district. The phosphorite deposits occur primarily near the top and botton of the Meade Peak Member. The highest concentration of phosphate is 30 to 36 percent, as it occurs in the bottom ore zone, which is 30 to 60 feet thick in southwestern Idaho. The phosphate content decreases to 28 percent or less as the ore zone thins to about 20 feet going northward into Montana and southward into Wyoming and Utah. The upper phosphate zone is about 30 feet thick and is consistently lower in phosphate content—from 30 percent P_2O_5 in isolated occurrences to a more common concentration of 15 to 20 percent throughout. About 80 percent of reserves recoverable, given current economics and technology, occur in the lower ore zone in southeastern Idaho (see Figure 1). The remaining members of the Phosphoria Formation contain minor amounts of phosphate, the most important of which is the Retort Phosphatic Shale Member. It is 40 to 80 feet thick and contains phosphate occurrences of from less than 2 percent to 25 percent. It is mined only on a local basis.

Mineral Occurrences

The phosphate occurs primarily as fine-grained pellets of carbonate fluorapatite. The percentage of phosphate content has been upgraded as the result of alteration of the apatite. Essentially all phosphatic beds of the formation contain uranium in amounts of 0.001 to 0.03 percent U_3O_8 in association with the fluorapatite. As the percentage of phosphate content increases, so does the uranium. Thus, the highest percentage of contained uranium occurs in the lower ore zone of the Meade Peak Phosphatic Shale Member of the formation.

Vanadium is common to western phosphorite deposits. It is closely associated with the fluorapatite, and its percentage content is likewise increased as the carbonates are removed by rock alteration. The amount of V_2O_5 in the phosphate rock is approximately 0.18 to 0.25 percent. However, only about half of the contained vanadium enters the acid stream in the production of phosphoric acid.

Resources of Western Phosphates

Currently recoverable identified phosphate reserves are estimated to be 6,000,000,000 to 8,000,000,000 tonnes, most of which is located in southeastern Idaho. Such reserves are limited to depths of less than 1,000 feet, due to the steep dipping and highly folded and faulted beds. On the other hand, hypothetical resources are projected to depths of three to five thousand feet in certain areas, and are roughly estimated at 10,000,000,000 tonnes.

Phosphate Production

Phosphate from the Phosphoria Formation amounts to about 11 percent of total US production. Actual mine production of phosphate rock totaled approximately 6,500,000 tonnes in 1978. Of that total, 2,200,000 tonnes were committed to wet-process phosphoric acid production; the remaining 4,300,000 tonnes were converted to industrial and agricultural phosphate products via the elemental phosphorous process. Uranium contained in all phosphate rock mined in the US in 1978 is estimated at 1,400,000 pounds U_3O_8. The amount of uranium contained in the wet-process phosphoric acid, none of which was recovered, is estimated at 485,000 pounds U_3O_8.

Marine Phosphorites Outside the US

Almost 60 percent of the world's identified reserves are located in western and northern Africa (see Part I of this article, Table on pg. 3.2, in Report No. 136). Of that amount, 80 to 90 percent occurs in northwestern Morocco. Phosphate rock mined at two production centers in Morocco totaled almost 20,000,000 tonnes in 1978. Essentially all mine production was exported; phosphoric acid production for domestic use was less than 300,000 tonnes. The total phosphate rock mined contained about 8,400,000 lbs U_3O_8, none of which was recovered.

In Brazil, study is underway to determine the economic feasibility of extracting both phosphates and uranium from deposits near Itataia in the state of Ceará. Petrobrás Fertilizantes SA and Nuclebrás will spend $270,000 on the study with the expectation of producing within four to five years.

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STATISTICAL DATA

EXCHANGE VALUE — $40.75/lb U_3O_8

DEFINITION

The Exchange Value is Nuexco's judgment of the price at which transactions for significant quantities of natural uranium concentrates could be concluded as of the last day of the month.

DERIVATION

Nuexco bases the Exchange Value upon:

A. Data from recently completed transactions.
B. Data from pending transactions.
C. Firm bids to buy and firm offers to sell.
D. Prices purchasers have expressed a willingness to pay, but for which Nuexco is not aware of firm bids to buy, and prices sellers have expressed a willingness to accept, but for which Nuexco is not aware of firm offers to sell.

COMMENTS

Nuexco does not consider the following in determining the Exchange Value:

A. The price of uranium delivered or to be delivered under old contracts.
B. The price of uranium delivered in connection with contract renegotiations or other than arm's length transactions.

TRANSACTION VALUE			
$/lb U_3O_8	Millions of Pounds	Number of Transactions	Number of Months
42.30	2.1	13	6

DEFINITION

The Transaction Value is a weighted average price of recent transactions, and is based on prices paid for U_3O_8 in transactions closed within the previous three-month period and for which delivery was scheduled within one year of the transaction date. At least ten transactions totaling at least two million pounds U_3O_8 are included in each calculation, or the sample time is extended as necessary to include these minima. Foreign currencies are converted to US dollars as of the transaction date.

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STATISTICAL DATA

Figure 1
HISTORICAL EXCHANGE VALUES

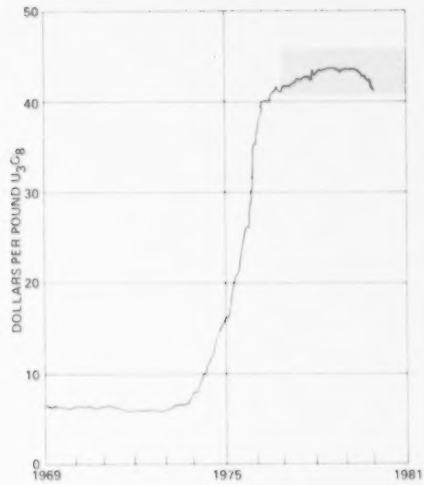


Figure 2
HISTORICAL TRANSACTION VALUES

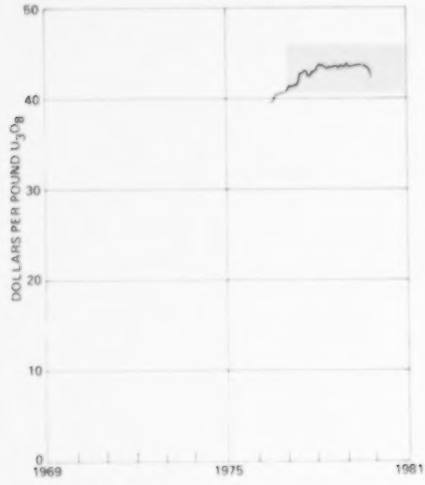
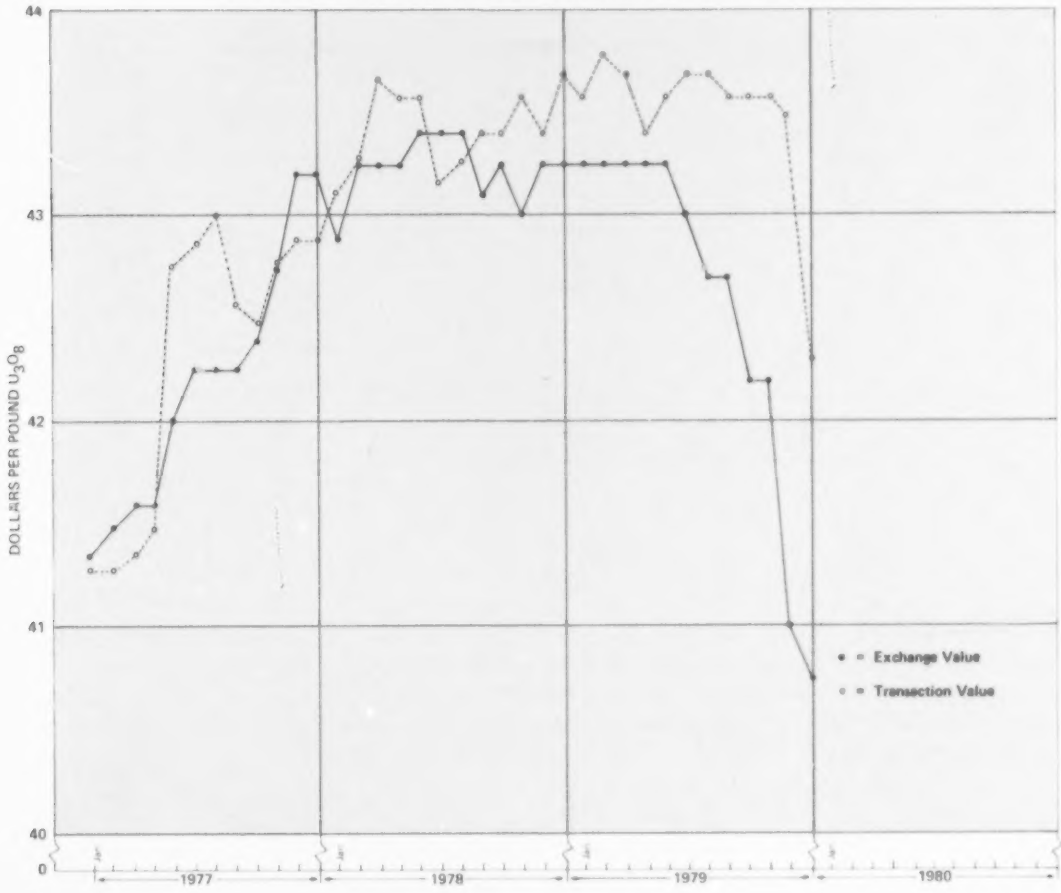


Figure 3
RECENT EXCHANGE AND TRANSACTION VALUES



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STATISTICAL DATA

EXCHANGE VALUE
US Dollars/lb U_3O_8

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1968	–	–	–	–	–	–	–	6.35	6.35	6.40	6.45	6.50
1969	–	6.35	6.10	6.10	6.25	6.25	6.20	6.20	6.15	6.15	6.15	6.20
1970	6.30	6.30	6.30	6.30	6.30	6.30	6.30	6.20	6.15	6.15	6.15	6.15
1971	6.20	6.20	6.20	6.20	6.15	6.05	6.00	5.95	5.95	5.95	5.95	5.95
1972	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95
1973	5.95	6.00	6.10	6.20	6.45	6.50	6.50	6.50	6.50	6.50	6.75	7.00
1974	7.70	7.90	8.00	9.00	9.50	10.50	11.50	12.00	12.50	14.00	14.75	15.00
1975	16.00	16.00	18.00	20.00	21.00	23.00	24.70	26.00	26.00	28.50	30.00	35.00
1976	35.20	37.00	39.25	40.00	40.00	40.00	40.00	40.40	41.00	41.00	41.50	41.00
1977	41.35	41.50	41.60	41.60	42.00	42.25	42.25	42.25	42.40	42.75	43.20	43.20
1978	42.90	43.25	43.25	43.25	43.40	43.40	43.40	43.10	43.25	43.00	43.25	43.25
1979	43.25	43.25	43.25	43.25	43.25	43.00	42.70	42.70	42.20	42.20	41.00	40.75

Note: See earlier Nuexco Reports for evolution of the definition of Exchange Value.

TRANSACTION VALUE
US Dollars/lb U_3O_8

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1976	–	–	–	–	39.60	39.70	39.70	40.40	40.30	40.60	40.70	40.70
1977	41.30	41.30	41.40	41.50	42.80	42.90	43.00	42.60	42.50	42.80	42.90	42.90
1978	43.10	43.30	43.70	43.60	43.60	43.20	43.30	43.40	43.40	43.60	43.40	43.70
1979	43.60	43.80	43.70	43.40	43.60	43.70	43.70	43.60	43.60	43.60	43.50	42.30

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STATISTICAL DATA

EXCHANGE VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES*

Country	per lb U_3O_8 in Concentrates	per kg U_3O_8 in Concentrates	per kg U in Concentrates
US (dollar)	40.75	89.84	105.94
France (franc)	163.92	361.38	426.15
FRG (mark)	70.27	154.92	182.69
Japan (yen)	9,796	21,596	25,467
Switzerland (franc)	64.92	143.12	168.78
UK (pound)	18.26	40.25	47.46
Australia (dollar)	36.78	81.08	95.61
Canada (dollar)	47.77	105.32	124.20
Niger, Gabon (CFA)	8,196	18,069	21,307
South Africa (rand)	33.68	74.25	87.55

* Calculated using currency exchange rates published in the Wall Street Journal on the last business day of the month.

LOAN USE CHARGE RATE — 7.0%/year

DEFINITION

The Loan Use Charge Rate is Nuexco's judgment of the annual interest rate at which uranium loans could be concluded as of the last day of the month.

DERIVATION

Nuexco bases the Loan Use Charge Rate upon:

A. Data from recently completed or pending loan transactions.
B. Rates included in firm proposals to borrow or lend.
C. Rates that potential borrowers and lenders have expressed a willingness to pay or accept, but for which Nuexco is not aware of firm proposals.

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STATISTICAL DATA

CURRENT TRANSACTIONS*

Ref	Delivery Period	Material & Approximate Quantity	Approximate Price as % of Current E.V.	Seller Group	Buyer Group	Remarks
1015	79	Less than 50,000 lbs U_3O_8	108%	Europe	Europe	UF_6; Not an arm's length transaction
1016	79	100,000 to 300,000 lbs U_3O_8	108%	Europe	Europe	Not an arm's length transaction
1017	79	100,000 to 300,000 lbs U_3O_8	100%	US	US	
1018	79	300,000 to 600,000 lbs U_3O_8	103%	US	US	
1022	80	50,000 to 100,000 lbs U_3O_8	98%	US	Pacific Basin	UF_6
1023	79	600,000 to 1,000,000 lbs U_3O_8	—	US	US	Loan; repayment in 1980

* Transactions listed include not only those in which Nuexco was involved, but also all others of which Nuexco is aware.

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STATISTICAL DATA

US GOVERNMENT STATISTICS

	Producer Price Index—Industrial Commodities (1967 = 100)[1]	Gross Average Hourly Earnings of Production or Non-Supervisory Workers[2]		
		Metal Mining (SIC 10)	**Primary Non-ferrous Metals (SIC 333)[3]**	**Chemicals and Allied Products (SIC 28)**
Annual Avg. 1970[4]	110.0	3.98		3.69
Annual Avg. 1971[4]	114.0	4.12		3.94
Annual Avg. 1972[4]	117.9	4.49		4.21
Annual Avg. 1973[4]	125.9	4.82		4.48
Annual Avg. 1974[4]	153.8	5.43		4.85
Annual Avg. 1975[4]	171.5	6.13		5.37
Annual Avg. 1976[4]	182.3	6.75		5.89
Annual Avg. 1977	195.1	7.27	7.66	6.39
Annual Avg. 1978	209.4	8.26	8.56	7.01
Sept 1978	212.5	8.59	8.74	7.13
Oct 1978	214.7	8.64	8.83	7.19
Nov 1978	216.0	8.74	8.86	7.22
Dec 1978	217.2	8.76	8.97	7.28
Jan 1979	220.0	8.75	9.01	7.32
Feb 1979	222.5	8.85	9.02	7.32
Mar 1979	225.4	8.88	9.11	7.36
Apr 1979	229.0	9.07	9.49	7.50
May 1979	231.6	9.09	9.14	7.46
Jun 1979	234.0R	9.12	9.43	7.52
Jul 1979	237.5R	9.32	9.57	7.60
Aug 1979	240.3	9.38	9.70	7.65
Sept 1979	243.8	9.63	9.79	7.73
Oct 1979	248.5	9.70P	9.87P	7.81P
Nov 1979	250.2			7.87P

(1) Final revisions to 1977 data are as indicated. Producer Price Indexes are now routinely revised four months after they are first released to reflect the availability of late reports and corrections by respondents. Source: Bureau of Labor Statistics, *Producer Prices and Price Indexes*, Table 6. (Formerly *Wholesale Prices and Price Indexes)*

(2) Source: Bureau of Labor Statistics, *Employment and Earnings*, Table C-2.

(3) Monthly data for 1977 and 1978 appear in Report No. 125, dated December 31, 1978.

(4) Monthly data for these years appear in Section 10 of Report No. 107, dated June 30, 1977.

P = Preliminary

R = Revised

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MARKET OPPORTUNITIES

Market Opportunities are *active* inquiries in the uranium market to buy, sell, borrow or lend. The data presented in this section are in no way intended to be indicative of the entire uranium market for the time period covered.

SUPPLY

Uranium Available for Sale

Delivery Year	Pounds U_3O_8 (1000's)	Nuexco Reference Number	Remarks
1980	650	1325	
	350	1270	
	100	1292	
	300	1333	
	600	1338	
	400	1274	
	350	1284	
	500	1324	
	500	1285	
1981	100	1306	
	300	1274	
	300	1286	
	500	1324	
1982	300	1274	
	200	1306	
	300	1286	
	200	1315	
1983	300	1286	
	200	1306	
	200	1315	

Uranium Available for Loan

Delivery Year	Return Year	Pounds U_3O_8 (1000's)	Nuexco Reference Number	Remarks
1980	1981	1000	1136	
	1982	725	1175	UF_6
	1983	1000	1196	
	1983	1000	1136	UF_6
	1983	1000	1239	UF_6
	1983	700	1234	

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MARKET OPPORTUNITIES

DEMAND

Inquiries to Purchase Uranium

Delivery Year	Pounds U_3O_8 (1000's)	Nuexco Reference Number	Remarks
1980	500	1323	
	450	1337	
	1000	1334	
	500	1335	
1981	500	1228	
	250	1337	
	800	1260	
1982	300	1146	
	300	1227	
	250	1337	
	500	1228	
	400	1321	
1983	400	1321	
	250	1322	
	500	1228	

Inquiries to Borrow Uranium

Delivery Year	Return Year	Pounds U_3O_8 (1000's)	Nuexco Reference Number	Remarks
1980	1982	500	1121	
	1982	500	1135	
	1984	1000	1220	
	1983	1000	1240	

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ANNUAL SUMMARY — 1979

REPORT HIGHLIGHTS OF 1979

January No. 126	Public & Gov't. Policy:	Chinese political philosophy vis à vis nuclear power
	General:	Premium price for 'stringless' uranium
	Australia:	Marketing of Ranger; softening of Labor Party opposition to uranium development; Koongarra EIS filed.
	Canada:	Favorable reports on exploration activity
	Central Africa:	CFA/US dollar uranium price relationships
	Europe:	Swiss opponents of nuclear power intensify campaign
	Japan:	Uranium procurement activities
	Southern Africa:	Floating Rand in South Africa; negotiations for Namibian independence
	United States:	Buying patterns; emergence of new producers
	Exchange Value:	Unchanged at $43.25; balance in current market; possible re-emergence of two-tiered price structure
	Raw Materials:	Elliot Lake District, Ontario
February No. 127	Public & Gov't. Policy:	Swiss anti-nuclear referendum defeated; several governments strengthen nuclear programs; anti-nuclear activism wanes in Australia
	General:	1978 contracts by US sellers
	Australia:	South Australian uranium policy; status of Ranger and Queensland
	Europe:	Swiss nuclear referendum narrowly defeated
	Japan:	Uranium procurement policy
	Southern Africa:	1978 uranium production in South Africa; Namibia update
	United States:	Market activity; uranium loans
	Exchange Value:	Unchanged at $43.25; discussion of two-tiered price structure
	Raw Materials:	Wyoming Tertiary Basins
Topical Report: March 19	Non-proliferation and the Uranium Market	
March No. 128	Public & Gov't. Policy:	Three Mile Island (TMI)
	General:	Nuexco estimates of world consumption of uranium
	Australia:	Market status of Ranger, Queensland and Western; deterioration of Labor Party opposition to uranium development
	Canada:	Exploration activity in the Northwest Territories
	Europe:	Badenwerk's KKP-1 achieved criticality; European dissatisfaction with US policy on uranium reprocessing and retransfer
	Japan:	Buying trends

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March (cont.)	Southern Africa:	Rossing mill repaired; new production centers in South Africa
	United States:	Interest shifts to post-1980 deliveries
	Exchange Value:	Unchanged at $43.25; declining constant dollar price of uranium
	Topical Essay:	Conflict in Nuclear Power Policy
	Raw Materials:	Uranium Deposits
April No. 129	Public & Gov't. Policy:	US Nuclear Regulatory Commission (NRC) response to TMI; international policy news
	Australia:	Marketing efforts accelerate; altered nature of marketplace
	Canada:	1978 exploration expenditures; potential for new discoveries
	Far East:	Status of nuclear power programs in Taiwan, Korea, the Philippines; Japanese buyers temporarily inactive
	United States:	High level of market activity, but few transactions close
	Exchange Value:	Unchanged at $43.25
	Raw Materials:	South Africa
Topical Report: May 8	Implications of the Three Mile Island Incident	
May No. 130	Public & Gov't. Policy:	USNRC imposes three-month moratorium on licensing; FRG postpones reprocessing indefinitely; damages awarded in Silkwood case
	Australia:	Australian government encounters difficulty in marketing its share of Ranger output; international safeguards agreements concluded
	Canada:	Export of uranium and nuclear technology
	Europe:	Market activity; buying patterns
	Japan:	Status of supply
	Southern Africa:	Two long-term contracts; diminishing premium for 'stringless' uranium
	United States:	Spot market quiet; effects of renegotiations and litigations
	Exchange Value:	Unchanged at $43.25
	Topical Essay:	Exchange Value and Transaction Value
	Raw Materials:	Geochemical Prospecting
Topical Report: June 15	World Uranium Resources	
June No. 131	Public & Gov't. Policy:	Strong EEC support for nuclear power
	General:	World market synopsis

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June (cont.)	Australia:	Acceierating activity
	Canada:	Saskatchewan production
	France:	Uranium fuel cycle programs
	Japan:	Status of nuclear power program
	United States:	Market inactivity continues
	Exchange Value:	Edged downward to $43.00
	Raw Materials:	Overview of Uranium Reserves
July No. 132	Public & Gov't. Policy:	New US energy program announced
	General:	Revised Nuexco estimates of uranium consumption
	Australia:	Marketing efforts delayed
	Canada:	Westinghouse litigation development
	Japan:	Supply and demand
	Southern Africa:	Revised uranium resource estimates for South Africa
	United States:	Church Rock mill shutdown; effect of conversion contracts
	Exchange Value:	Decreased to $42.70; little near-term demand without concessions
	Topical Essay:	Uranium Loans
	Raw Materials:	Chattanooga Shale
August No. 133	Public & Gov't. Policy:	Former US Energy Secretary's view of US energy problem
	General:	Nuexco estimates of future US production
	Australia:	Queensland enters the market; government offers its share of Ranger; international safeguards agreements concluded
	Europe:	Market sluggish
	Japan:	Government pressures utilities to acquire equity in Ranger
	Southern Africa:	Political uncertainty in Namibia persists
	United States:	NRC, EPA disagree over mill tailings jurisdiction; production outlook clouded by declining ore grade; export transactions to date this year
	Pricing:	Exchange Value unchanged as gap grows between buyers' and sellers' perceptions of price; discussion of factors influencing Transaction Value; table of Transaction Values and associated factors
	Topical Essay:	The Uranium Industry in France and Germany
	Raw Materials:	Mexico Update
Topical Report: September 14	Uranium Supply and Demand in Japan	

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September No. 134	General:	Nuexco estimates of future world production
	Australia:	ACTU refused to endorse Ranger and Nabarlek
	Canada:	Staged development urged for Saskatchewan mines; Agnew Lake Mines announces planned closure of uranium operations
	Japan:	Inactivity continues
	Southern Africa:	New production records set at Rossing
	United States:	1979 DOE market price averages; federal judge refused to halt mining in the San Juan Basin
	Pricing:	Exchange Value fell $0.50 to $42.20
	Topical Essay:	Marketing and Procurement—Tools of the Trade I (bids, offers, inquiries)
	Raw Materials:	The Northern Colorado Plateau Uranium District
October No. 135	Public & Gov't. Policy:	Findings of US commission on TMI accident; antitrust litigation development in Britain
	General:	World Uranium Supply and Demand Balance
	Australia:	Status of marketing efforts
	Canada:	Saskatchewan exploration expenditures; government considers liquidating uranium stockpile
	Central Africa:	Rich deposit discovered in Asphalt district of Niger
	Europe:	Nuclear power stance of Swedish political parties
	Southern Africa:	Third quarter South African production up 12%
	United States:	Export-import balance; Nuexco concludes little likelihood of new US uranium export or import embargo
	Pricing:	Exchange Value unchanged at $42.20; sellers continue to resist price drop; buyers' market strength grows; present value concept removed from Transaction Value calculation; Transaction Value recomputed for past months
	Topical Essay:	Marketing and Procurement—Tools of the Trade II (brokers)
	Raw Materials:	Northeastern Washington Uranium District
November No. 136	General:	US Supply and Demand Balance
	Australia:	Ranger partners' sales to Korea; government's aggressive and co-ordinated marketing efforts reflect determination to acquire position in world market
	Canada:	Several transactions involving Canadian producers closed
	United States:	Imbalance in spot and near-term markets
	Pricing:	Exchange Value resumed decline, dropped $1.20; loan transaction closed

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November (cont.)	Topical Essay:	Spot and Other Markets (third in a series)
	Raw Materials:	By-product Uranium from Phosphate — Part I
December No. 137	Public & Gov't. Policy:	Effect of Middle East situation on energy programs and uranium demand; economic boom in South Africa and Australia; antitrust litigation development in Britain
	Australia:	Australian government sells its share of Ranger to Peko-Wallsend Ltd.— new company formed to handle the resulting 75% equity share
	Canada:	Saskatchewan to hold public hearings on uranium development in January 1980
	Japan:	Market activity; price negotiations; Japanese utilities to be involved in Peko-Wallsend's interest in Ranger
	United States:	IRS issued letter ruling concerning tax implications of uranium producers borrowing material for resale; mill tailings jurisdiction question resolved; New Mexico state legislature to consider an increase in the severance tax on uranium and other energy minerals during January 1980 session
	Pricing:	Exchange Value declined to $40.75; market outlook for producers; comparison of Exchange Value with what was shown to be an incentive price in 1960
	Topical Essay:	Uranium Prices & Price Mechanisms
	Raw Materials:	By-product Uranium from Phosphate — Part II
	Annual Summary:	Report Highlights of 1979

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EXECUTIVE SUMMARY & INDUSTRY OVERVIEW
NUEXCO REPORT NO. 137
Prepared Especially for Upper and Middle Management

Events in the Middle East may force the more industrialized nations to accelerate energy programs which reduce dependence on oil. While this is unlikely to cause a significant increase in short-term uranium demand, or in the number of *new* nuclear power plants ordered in the next few years, it might well help to slow, or even reverse, the growth of various barriers to nuclear power development.

The Australian government announced that it will sell its 50 percent share of Ranger to Peko-Wallsend Ltd. A new company, Energy Resources of Australia Ltd., will be formed to hold that share, plus the 25 percent interest now held by Peko in its joint venture with Electrolytic Zinc.

Public hearings on all facets of uranium development in Saskatchewan will be held in the province beginning in January 1980. Rulings are expected to favor continued uranium development.

Recent price negotiations and purchases demonstrate Japanese buyers' sensitivity to both the current uranium price decrease and the stronger position of buyers in the marketplace, and make them less likely candidates for additional purchases during the 1980's.

In January, the legislature of the state of New Mexico will consider an increase in the severance tax on uranium.

Exchange Value dropped $0.25 to $40.75 per pound U_3O_8, showing the additional pressure being exerted on prices by the presence in the market of inventory holders wishing to make spot sales. **Transactior. Value** dropped substantially to $42.30 per pound U_3O_8 as older, higher-priced transactions dropped from the calculation sample.

This month's *Topical Essay* on uranium prices and price mechanisms is the fourth in a series on various aspects of the uranium market.

Raw Materials continues a discussion of by-product uranium from phosphate.

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12/31/79

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